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BORDEN'S REVIEW *of* NUTRITION RESEARCH

SELF-SELECTION OF DIET
II. EXPERIMENTAL INVESTIGATION

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SELF-SELECTION OF DIET
II. EXPERIMENTAL INVESTIGATION

By RUTH WOODS

The continued survival of man and animals through the ages is a strong indication of the existence of a marked instinct for the proper selection of food. Studies of food habits by nutritionists, agriculturalists, anthropologists and others have, in general, tended to support the concept of self-selection as a means of securing an adequate diet.* The validity of this assumption, nevertheless, remains a matter of great controversy. Scientific studies, still in progress, have afforded a means of investigating the problem. Although the final answer has not yet been found, such studies have revealed a great deal concerning the significance of appetite and eating behavior in both animals and man.

The Concept of Physiological Homeostasis:

The scientific foundation for the belief that the animal organism, under certain conditions, is able to select nutrients according to its specific needs lies in the early physiological studies of Claude Bernard and, even more so, in the later observations of Walter Cannon.

Physiological and Chemical Regulators: The so-called internal environment of the body and its relation to the maintenance of life were first described in 1859 by Claude Bernard (1). He pointed out that, in mammals, if life is to be maintained, the internal environment (chiefly body fluids) must remain fairly constant regardless of the extremes of outside environmental changes. Variations in the internal milieu, beyond certain narrow limits, were found to be not compatible with life. Bernard described many of the automatic physiological mechanisms by means of which the internal environment is kept more or less constant as evidence of this hypothesis of self-regulation.

Bernard's concept was reiterated and more widely extended by the comprehensive studies of Cannon some seventy years later. In his classic book, "The Wisdom of the Body" (2), Cannon elaborated the concept of a constant internal environment or, as he termed the condition, "homeostasis." He demonstrated that internal homeostasis is maintained by the intricate interplay and balance of many physiological processes involving the heart,

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*cf. *Borden's Review of Nutrition Research*, May, 1949, "A History of Self-Selection of Diet."

lungs, kidneys, nervous system, etc. The maintenance of a constant body temperature (within narrowly fluctuating limits) regardless of external influences is a typical example of the action of physiological regulators. When, for example, an animal is placed in a cold external environment and thereby threatened with a decrease in body temperature below that compatible with life, a series of regulating mechanisms is immediately and automatically brought into action in order to maintain the body temperature at normal levels. Loss of body heat is minimized by decreased activity of the sweat glands and by constriction of the peripheral blood vessels; extra heat is produced by an increased burning of stored fat and by the act of shivering—a form of involuntary exercise.

Behavior Regulators: The maintenance of internal homeostasis as described by both Bernard and Cannon involves the action of physiological and chemical regulators in the body. Still another type of regulatory mechanism has been suggested more recently by the experiments of Richter and associates (3). They postulate that a constant internal environment is maintained not only by internal physiological mechanisms, but by general *behavior* of the animal or, what they term, *"total organism regulators."* A great deal of supportive evidence for the self-selection of adequate diets stems from the work of Richter's group; the nature of their concept of total self-regulatory functions and the significance of their findings will be discussed later in this Review.

Early Experimental Studies:

The scientific investigation of diet selection by animals received little attention prior to about 1933. Those studies which were reported were largely inconclusive because of limited data or, more particularly, because of the use of complex foods rather than of purified components. As early as 1918, Osborne and Mendel (4) and, later, Mitchell and Mendel (5) found that in certain cases rats or mice preferred an adequate diet to an inadequate one when offered a choice of two laboratory diets. Because such choices were not made without exception and because of their limited data, these studies remained somewhat inconclusive. Not until about ten years later was further information on this subject forthcoming. At that time, Beadles and coworkers (6) reported the negative findings that rats were unable to distinguish a low protein diet of deficient quality from a similar diet made adequate by supplementation with cystine. Similarly disappointing results were obtained by Kon (7) who found that rats might fail to take enough protein even to keep them alive if allowed to choose their own allowance of a carbohydrate, protein and salt mixture. Interesting findings were re-

ported by Harlow (8) in 1932. He allowed normal rats, previously fed the standard basal McCollum diet, to choose food from four cups containing different materials. The animals showed equal preference for the McCollum diet and for a diet of meat scraps. Cheese was next in preference, while corn was least preferred. Animals previously fed a special diet of corn, lettuce and milk, however, showed a marked preference for meat over the standard McCollum diet. The addition of lettuce to the preliminary McCollum diet, inexplicably, resulted in a marked preference for the McCollum diet over meat as opposed to the equal choice of both ordinarily exhibited by the first group. Harlow concluded, therefore, that appetite and food choice were influenced, under conditions of his experiment, not by appearance or odor of food, but by the nature of the previous diet.

In 1933, Harris and associates (9) published the first comprehensive study of an appetite for a single factor. They demonstrated that thiamine-deficient rats developed a definite preference for thiamine-containing foods over thiamine-free foods. Normal rats chose either diet until thiamine deficiency occurred and then showed a preference for the vitamin-containing diet. Under certain circumstances, however, such choices became impossible. Too large a selection of foods often resulted in an inability to "discover" the vitamin-containing food. Feeding the vitamin-containing food alone for a few days, however, "educated" the animal to detect it amongst the same large variety offered later. Too small an amount of the vitamin resulted in failure to distinguish the vitamin-containing foods from those devoid of the vitamin. Similarly, association of the vitamin with a distinctive flavoring material deluded the animals into eating a similarly flavored vitamin-free food. It was concluded therefore that,

> "the ability of the vitamin B-depleted rat to discriminate between diets containing the vitamin and those deficient in it depends not on vague instinct but on an association between the distinctive character of the diet (smell, taste or appearance) and an experience of the prompt beneficial effects, e.g., on appetite, alimentary tone, etc., which follow immediately on its consumption. With certain other dietary essentials, where the benefit is less immediately apparent, the rat is unable to distinguish between the deficient and the adequate diets. The factor of "experience" is believed to be of wide significance in determining dietary preferences in general."

Studies with Purified Dietary Components—Positive Findings:

Following these early studies, the problem of self-selection of diet was approached from the viewpoint based on the concept of homeostasis originally outlined by Bernard and Cannon. This concept was further elaborated

by Richter (3) who demonstrated that animals possess not only physiological and chemical regulators, but "behavior" regulators which operate to maintain a constant internal environment under stress of special conditions.

Endocrinological Studies: The first studies along these lines were based on experiments with the endocrine glands. Richter and associates demonstrated that after the elimination of physiological regulators, the animals themselves made an effort to maintain a homeostatic condition. For example, surgical removal of the adrenal glands from animals eliminates their physiological control of sodium metabolism. As a result, large amounts of sodium are excreted in the urine thereby greatly disturbing the internal environment (10). If given access only to a stock diet such animals die in one to two weeks. However, if in addition to their diet, they are given access to ordinary tap water and to a salt solution, they invariably choose the salt water for drinking (11). In this way the body loss of salt is replaced and homeostasis is maintained. By this altered appetite behavior, the animals keep themselves alive and free from symptoms of adrenal insufficiency. When normal adrenal cortex activity is restored by injections of cortical extract, an immediate drop in salt appetite to normal levels occurs.

In the same way it was shown that parathyroidectomized rats which, on a regular diet, develop tetany and usually die in a few days, will, if given access to a calcium solution, take enough of it to keep alive and free from tetany (12).

Removal of the pancreas which regulate carbohydrate metabolism (by supplying insulin) similarly caused compensatory changes in appetite (13). Large amounts of water were taken, presumably to aid in eliminating unused glucose. When kept on a regular mixed diet high in carbohydrate such animals ate voraciously to obtain needed amounts of other food elements which they were able to use. Despite this, weight gain was below normal. When offered a choice of pure carbohyrate, fat or protein, these diabetic animals refused the carbohydrate and ate large amounts of fat and protein. As a result symptoms of diabetes disappeared: blood sugar fell to normal levels, they gained weight, ate less food and drank only normal amounts of water.

Removal of the posterior lobe of the pituitary eliminates one of the main regulators of water metabolism by removing the anti-diuretic hormone. Consequently such animals excrete large amounts of urine, become dehydrated and soon die. If given access to unlimited amounts of water, they rapidly increase their intake (often to as much as twice the body weight per day), thereby keeping themselves alive and in good health (14).

According to these investigators, studies such as these afford a means of demon-

strating two important principles: (1) When physiological regulators (like an endocrine gland) are interfered with, *appetite* may serve as a reliable emergency regulator to maintain a normal internal environment; (2) such specific changes in appetite can be used as a means of determining both the nature of the metabolic change (such as loss of adrenal function), as well as the altered dietary requirements of such animals (such as the vital need for increased salt in adrenalectomized animals).

Nutrition Studies: In 1937, Richter's laboratory published a report on the self-selection of diet by normal animals offered a diet composed of highly purified substances (15). The study was based on the assumption that normal rats might make reasonable food selections similar to those made by abnormal rats in the earlier studies on endocrinological disturbances. In a preliminary experiment, the animals were given access to eleven substances, one source of each of the substances known to be important in nutrition:

Foodstuff	*Source of*
sucrose	carbohydrate
casein (vitamin-free)	protein
olive oil	fat
sodium chloride	minerals
potassium chloride	
calcium lactate	
dibasic sodium phosphate	
cod liver oil	vitamins
wheat germ oil	
baker's yeast (dried)	
water (tap)	water

On the selections made from these substances, the rats thrived and grew well, reproduced normally and showed no signs of deficiency during the entire experimental period of 500 days. That the choices were not only adequate *but efficient* was shown by the fact that although they grew at the same rate as control rats on the stock diet, their total food intake as measured in grams was 36 per cent less.

This basic method was used to determine dietary interrelationships, dietary requirements under varying metabolic conditions and other questions of nutritional significance.

(Vitamin B Complex Studies): In later experiments, yeast was omitted and replaced by various components of the vitamin B complex, singly and in various combinations. This offered a means of determining dietary interrelationships between these and other constituents of the diet. When no

yeast or B vitamins were available, the rats ate large amounts of fat, little or no carbohydrate and no protein (16, 17). They thus indicated that without vitamin B they could use fat, but not carbohydrate or protein. When thiamine was given they ate more carbohydrate and less fat, but still no protein. As further members of the B complex were added more carbohydrate and protein and less fat were taken. By controlling the individual components of the B complex offered for choice, the protein, fat and carbohydrate appetites could be predicted and controlled at will by the experimenters.

(Nutritional Needs in Pregnancy and Lactation): Using the same eleven substances, records were made of the intake of each for several weeks before mating, during pregnancy, during lactation and for several weeks after the litters were weaned (18). Calcium intake increased slightly during pregnancy and markedly during lactation at the height of which it reached peaks 30-40 times as high as the average daily intake before mating. After weaning, calcium appetite returned slowly to original levels. Similar changes occurred in phosphorus intake; no changes occurred in potassium intake during pregnancy or lactation, although a sharp drop in intake occurred after weaning. Fat and protein intake increased slightly during pregnancy; markedly during lactation and dropped rapidly after weaning. Carbohydrate intake remained constant.

Efficiency of food selection was demonstrated by the fact that the food intake, in grams, was about 20 per cent less during pregnancy and almost 50 per cent less during lactation than that of control animals on the stock diet nursing the same number of babies. The babies produced on the self-selected diet were comparable in weight and health to those produced by animals on the stock diet. The smaller intake of the self-selection group was explained by the fact that they chose more of their needed nutrients without eating a large amount of other, unnecessary foodstuffs.*

The choices of these animals approximated closely the known facts concerning the altered nutritional requirements during pregnancy and lactation.

(Other Nutrition Principles): Using the same technique, Richter's group has been able to demonstrate a number of interesting nutrition principles as evidenced by the voluntary food choices of their animals. Thus, they found that an inverse relationship exists between fat and carbohydrate appetites; if large amounts of one are eaten, the intake of the other is correspondingly dropped. Another finding was that rats will make every effort to keep their

*This was possible, of course, because their diet offered the various nutritive essentials individually and in relatively purified form.

daily caloric intake at a fixed level. If made to satisfy their thirst by drinking water containing varying proportions of alcohol, the animals decreased their food intake in direct proportion to the caloric value of the added alcohol (19).

Some of the most interesting results have been obtained by using the self-selection method in single food choice experiments in which the rats have access to only one purified food (a fat, carbohydrate or protein) or to a single whole food such as corn, graham flour, peanuts, etc., either alone or with access to one or more vitamins, minerals or enzymes (20). Dietary interrelationships and nutritional deficiencies of individual foods can be more clearly brought out under such experimental conditions than when mixtures of foodstuffs are fed.

Negative Findings:

The study of self-selection of diet by animals was greatly stimulated by the findings of Richter and associates and although some of their observations have been confirmed, other investigators have reported equivocal or even negative results. Thus, Wilder (21) found that rachitic rats could not select the beneficial diet when offered a choice between a rachitic and antirachitic diet. This was confirmed some years later by Young and Wittenborn (22). Richter *et al* (23) on the other hand, found that rats voluntarily consumed large amounts of cod liver oil to compensate for a dietary deficiency. In a later study Young (24) concluded food choices were a matter of psychological behavior rather than a reflection of nutritional need. He found that the animals usually sample all the foods first; that preferences changed during the course of a meal, or from day to day and were often influenced by foods previously eaten, the nature of the basal diet or the favored position of a food cup, regardless of its contents.

In experiments with chickens, Jukes (25) found that riboflavin-deficient animals could not distinguish between a diet containing riboflavin and a similar one free of the vitamin. Further, the chickens could not be "educated" to choose the correct food as had been done with rats by Harris *et al* (9). The chickens refused consistently to eat alfalfa meal, which contains riboflavin and vitamin A, even though suffering from a lack of these vitamins. Moreover, the animals showed a marked position orientation, preferring to eat from the compartment in a corner of the cage. Partial confirmation of Richter's work can be found in the studies of Clark and Clausen (26), Warkentin *et al* (27) and Scott *et al* (28-34). Clark and Clausen were able to demonstrate several of the principles brought out by Richter's studies:

the inverse relationship between fat and carbohydrate appetite; the constancy of caloric intake; the increase in salt appetite following adrenalectomy. The decrease in glucose intake and increase in water reported by Richter for adrenalectomized rats was not observed by these investigators. The studies of Warkentin *et al* centered chiefly around the investigation of appetite changes associated with experimental thyroid abnormalities. No differences in food preferences were observed with hypothyroid or hyperthyroid rats except, of course, an expected change in caloric intake. When the animals were offered a basic diet containing a mixture of yeast and mineral salts, purified protein, fat and carbohydrate, less than half of them chose a balanced supply of these ingredients. Their intake of protein and of the yeast-mineral mixture was low, the latter probably because of the excessively salty taste of the yeast. This was similar to the observation of Kon (7) whose rats failed to eat enough protein to sustain life on a self-selected diet containing a fixed level of yeast. When the yeast was offered alone, separated from the salts, the animals increased their intake of yeast as well as of protein to optimum levels and made successful selections of other nutrients as well (27). The reciprocal fat-carbohydrate relationship was again noted; protein intake varied slightly in relation to total calories. Warkentin *et al* reached the general conclusion that under their experimental conditions, the animals ate chiefly for calories rather than for specific nutrients.

The experiments of Scott and associates were more extensive than those just cited and extended over a period of years. In the first study Scott (28) reported findings chiefly negative in character. Of 87 animals offered a choice of a purified diet, 34 failed to select properly and did not grow. Their appetites, except for mineral salts and calories showed no apparent relation to physiological or nutritional needs. In a later study involving selection of B vitamins, Scott and Quint (30) found that animals fed diets deficient in each of the B vitamins, thiamine, riboflavin or pyridoxine, respectively, developed an appetite for foods containing these vitamins. Normal animals did not exhibit such appetites. Appetites for pantothenic acid were not developed by animals deficient in this factor unless the foods containing this vitamin were "labeled" with a characteristic flavor. This suggested the possibility that the appetite for pantothenic acid is a learned or educated appetite, while appetites for the other B vitamins might be either more easily "learned" appetites or possibly true hungers related to nutritional need. In a comparable study with four typical proteins (casein, lactalbumen, fibrin and egg albumen) it was concluded that no appetite for protein exists in the rat, other than simple preferences for one or the other, unrelated, apparently to need (31). Similarly, a study of carbohydrates revealed an

inverse proportion to the intake of fat; no apparent relation to nutritional need and selection somewhat dependent on the method of offering the choice (32).

Self-Selection Studies In Man:

As has been pointed out in a previous Review,* self-selection of diet by man provides an adequate diet only when choices can be made without the influence of "civilization," (with its modern, highly refined foods and persuasive advertising) or of religious, economic, political or cultural dictates. Experimental studies with adult subjects, or even older children, already subjected to and swayed by these influences can not be expected to give a true picture of natural food habits. For this reason, the oft-cited classic experiments of Davis with newborn and newly-weaned infants are of profound interest and significance to students of the phenomenon of self-selection (Table 1).

Newly-Weaned Infants: Breast-fed infants of weaning age (six to eleven months old) who had never had supplements of ordinary adult foods were studied for a period of six years by Davis (35, 36). These children were uninfluenced by adult ideas and were, naturally, without preconceived food prejudices or biases. They were offered a wide range of natural, simple foods; unmixed and unseasoned. Refined, canned or incomplete foods were not used. Foods such as oat meal, wheat, beef, eggs, bone marrow, carrots, peas, cabbage and apples, were served both raw and cooked; food combinations (custards, soups, bread) were avoided to insure that each food was chosen for itself alone and not some other ingredient. The basic 34 foods offered were divided into three meals and offered in individual dishes on trays. Each meal provided sweet and sour (lactic) milk, two kinds of cereals, animal protein foods and either fruits or vegetables. Salt was served in a separate dish; milk was not poured over cereals, etc. The infants indicated their choices by pointing or by attempting to feed themselves from the various containers. Where necessary they were assisted without comment or suggestion by nurses who fed one spoonful at a time of the foods indicated if the child opened his mouth. The nurses refrained from attracting attention to any food or from refusing to feed any food no matter how much had already been eaten. When portions of certain foods were eaten completely, the servings at the next meal were increased to insure that the child had all he wanted.

**cf. Borden's Review of Nutrition Research,* May, 1949, "A History of Self-Selection of Diet."

Table 1—Foods Offered for Self-Selection

1. Water	18. Potatoes
2. Sweet milk	19. Lettuce
3. Sour (lactic) milk	20. Oatmeal
4. Sea salt (seisal)	21. Wheat
5. Apples	22. Corn meal
6. Bananas	23. Barley
7. Orange juice	24. Ry-Krisp
8. Fresh pineapple	25. Beef
9. Peaches	26. Lamb
10. Tomatoes	27. Bone marrow
11. Beets	28. Bone jelly
12. Carrots	29. Chicken
13. Peas	30. Sweetbreads
14. Turnips	31. Brains
15. Cauliflower	32. Liver
16. Cabbage	33. Kidneys
17. Spinach	34. Fish (haddock)

Although the foods chosen and eaten by the children were often unusual in quantity and in combination from a conventional standpoint, the diets over a period of time proved to be exceptionally well balanced. Thus, a typical breakfast might include the strange combination of liver and a pint of orange juice; food "jags" involving the eating of large numbers of eggs or bananas at successive meals and similar unorthodox eating habits often occurred. Nevertheless, the children developed and grew normally, were free of digestive upsets or intestinal disorders and presented no evidence of lack of appetite or of other feeding problems. Each of the children exhibited a different food preference pattern, yet all were well-nourished and managed to secure a diet of high nutritional value. The study demonstrated that children offered a varied selection of natural, wholesome foods are capable of making good selections and thereby maintaining themselves in optimum health. It also disproved the then current theory in pediatrics that young children are unable to eat meats and other simple foods of the adult diet.

Studies with Newborn Infants: In a later study, Davis (37) reported findings on the self-selection of formulas and quantities by three newborn infants. Each baby was offered a choice of four formulas at each feeding. The order in which they were presented was rotated to avoid the influence of greater hunger at the beginning of a feeding. The infants chose all of the formulas equally well, except for lactic acid milk which was rejected often during the first two months of life, but readily accepted by older infants.

FORMULAS OFFERED.

1. A proprietary "reconstructed" milk requiring only the addition of water.
2. Fermented lactic acid milk plus Karo syrup.
3. A simple whole milk-water-lactose formula.
4. An orange juice, egg yolk, cane sugar, milk and water formula.

The infants were completely free from digestive troubles such as diarrhea, vomiting, constipation and colic. They slept soundly, seldom cried and exhibited the vigorous yet serene and contented behavior characteristic of the adequately fed breast-fed infant. Quantitative patterns of eating behavior varied extremely, from mere tastes at one feeding to unusually large amounts at others. As expressed by Davis:

> "This pattern of eating behavior, *i.e.* occasional 'stuffing' and meals of widely varying quantities is the natural one not only of mammalian young in general but also of the breast-fed baby. Furthermore, it is not merely an infantile pattern but one that continues to a greater or lesser degree throughout life. Artificially fed infants appear to be the only large group on whom identical quantities for successive meals are meticulously imposed, and one cannot but wonder whether the comfort of these infants who exercised choice not only of formulas but of quantities and their complete freedom from digestive discomforts and symptoms of any sort were not due rather to the following of this natural eating pattern than to the combinations made by their choices of formulas."

Older Children and Adults: Applying the principles derived from these self-selection studies to a group of older, hospitalized children was found to have markedly practical and beneficial results. Davis (38) reported improvement in eating habits and appetite, minimal food wastage and the selection of well-balanced adequate diets when children were allowed to select the foods they wanted as well as the amounts. These findings were confirmed from records of clinical experience by Sweet (39). Other studies by Richter (3) demonstrated an almost universal liking for cod liver oil in children about 5 years of age; this appetite, however, decreased with age, being markedly reduced by about the age of 14 years. Richter cites further the appetite adjustments made by children and adults whose physiological regulators have been interfered with through disease. Thus in Addison's disease (destruction of the adrenal cortex) there is a marked craving for salt or for salt rich food such as ham or sauerkraut, etc. In the latter instances the patients did not in any way associate the craving for these foods with their high salt content. Richter (40) cites the case of a 3½ year old boy with undiagnosed destruction of the adrenical cortex who kept himself alive for more than two years by eating tremendous quantities of salt by the handful. When the child was sent to a hospital for observation and

placed on the regular diet he soon developed symptoms of his disease and died. Another patient, an adult with severe Addison's disease, customarily put a 1/8-inch layer of salt on his steak, used nearly 1/2 glass of salt in his tomato juice, used salt on oranges and grapefruit, and even made lemonade with salt. The various appetite perversions cited in the previous Review* offer other examples of self-regulatory function in the absence of normal physiological regulators.

Conclusion:

The belief that unprejudiced appetites can serve as a sound guide to nutritional needs has arisen as a result of certain experimental, clinical and anthropological studies involving both animals and man. This phenomenon has been attributed variously to some unexplained "instinct;" to altered taste thresholds under conditions of nutritional or endocrine deficiency (3); or to "education" as a result of the experience of beneficial efforts from consuming an adequate diet (9, 33). Although a great deal of confirmatory evidence has been accumulated in apparent support of this belief, the general opinion of nutritionists is that more comprehensive studies subjected to careful statistical analysis are needed before any definite conclusions pro or con can be drawn.

Further, the circumstances of ordinary eating—even in laboratory animals—are so complex as to virtually prevent the satisfactory operation of an instinctive or learned appetite in selecting foods. As Scott and Verney (34) have pointed out in their analysis of the appetite for thiamine:

> "A simple, uncomplicated choice of the type obtained in these experimental studies will not ordinarily occur in actual feeding. Natural foods different in thiamine content will ordinarily be of different origins and will vary widely in flavor and in physical and chemical properties. Several other animals are much more selective in choice of food than are rats and are markedly influenced by flavor. Food choice in man in particular is influenced by a large number of social, cultural and economic factors which, with the exception of education based on scientific nutrition, appear to bear little if any relation to nutritional needs. Thus an appetite for thiamine under most actual feeding conditions can scarcely be anticipated on the basis of our studies. It appears then that a learned appetite for thiamine under certain conditions can lead to better nutrition than would wholly random eating, but that it cannot result in better nutrition than when the diet is prescribed on the basis of known nutritional needs."

Finally, the situation with respect to human subjects has been admirably summed up by Clara Davis (36):

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*cf. *Borden's Review of Nutrition Research*, May, 1949, "A History of Self-Selection of Diet."

"Such successful juggling and balancing of the more than thirty nutritional essentials that exist in mixed and different proportions in the foods from which they must be derived suggests at once the existence of some innate, automatic mechanism for its accomplishment, of which appetite is a part. It is certainly difficult to account for the success of the 15 unrelated infants on any other grounds.

"Also such success with the nutritional essentials suggests the possibility that appetite indicated one orthodox diet in terms of foods and the quantities of them, comparable to the diet lists of pediatricians and nutritionists. But to this possibility the self-chosen diets give not a scintilla of support . . . they failed to show any orthodoxy of their own and were wholly unorthodox with respect to pediatric practice . . . *Not one diet was the predominantly cereal and milk diet with smaller supplements of fruit, eggs and meat that is commonly thought proper for this age* . . . Tastes changed unpredictably . . . and meals were often combinations . . . that would have been a dietitian's nightmare. They achieved the goal, but by widely various means, as heaven may presumably be reached by different roads.

"This seemingly irresponsible and erratic behavior of appetite . . . stamps it as the same Puckish fellow we have always known it to be. Why then were his pranks so beneficent in the experiment when so harmful elsewhere? Or to put it boldly . . . What was the trick in the experiment? This brings us to the discussion of . . . appetite and its workings . . . its competencies and fallibilities.

"Selective appetite is primarily the desire for foods that please by smelling or tasting good and it would seem that in the absence of such sensory information, i.e., if one had never smelled or tasted a food, he could not know whether he liked or disliked it. Such proved to be the case with these infants. When the large trays of foods were placed before them at their first meals there was not the faintest sign of 'instinct' directed choice. On the contrary their choices were apparently wholly random; they tried not only foods but chewed hopefully the clean spoon, dishes, the edge of the tray, or piece of paper on it. Their faces showed expressions of surprise, followed by pleasure, indifference or dislike . . . Patterns of selective appetite were shown to develop on the basis of sensory experience, *i.e.,* taste, smell, and doubtless the feeling of comfort and well-being that followed eating . . . In short, they were developed by sampling, which is essentially a trial and error method. And it is this trial and error method, this willingness to sample, that accounts for the most glaring fallibility of appetite. From time immemorial adults as well as children have eaten castor oil beans, poisonous fish, toadstools and nightshade berries with fatal results. Against such error only the transmission of racial experience as knowledge can protect. Such error affords additional proof that in omnivorous eaters there is no 'instinct' pointing blindly to the 'good' or 'bad' in food. And since every trial and error method involves the possibility of error, *the problem of successful eating by appetite is that of reducing possible errors to those that are most trivial by a prior selection of the foods that are made available for eating.*

"By this time you have all doubtless perceived that the trick in the experiment (if 'trick' you wish to call it) was in the food list. Confined to natural, unprocessed and unpurified foods, as it was, and without made dishes of any sort, it reproduced to a large extent the conditions under which primitive peoples in many parts of the world have been shown to have had scientifically sound diets and excellent

nutrition. Errors the children's appetites must have made—but the errors with such a food list were too trivial and too easily compensated for to be of importance or even to be detected."

"Self-selection can have no, or but doubtful, value if the diet must be selected from inferior foods: Finally, by providing conditions under which appetite could function freely and beneficiently as in animals and primitive peoples, the experiment resolved the modern conflict between appetite and nutritional requirements. It eliminated anorexia and the eating problems that are the plague of feeding by the dosage method."

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